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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/802,593	03/17/2004	Chan-Yong Park	GAIN3.001AUS	3871

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EXAMINER

DICKEY, THOMAS L

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 12/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/802,593

Applicant(s)

PARK, CHAN-YONG

Examiner

Thomas L. Dickey

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) 11-25 and 31-34 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 7 and 26-30 is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 09/22/2005.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

1. The amendment filed on 9/18/05 has been entered.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 9/22/05 was filed after the mailing date of the first action on the merits on 3/18/05. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the examiner is considering the information disclosure statement.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 8, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by TANAKA et al. (2002/0117697).

The first embodiment of Tanaka et al. discloses a photodiode comprising a first conduction (n) type InP semiconductor layer substrate 1; a first conduction (n) type buffer layer 2 over the substrate 1; an anti-reflection layer 12 formed on a second surface of the substrate 1 which faces away from the first conduction (n) type buffer

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layer 2; an InAlAs/ InGaAs (at least one of an InAlAs and InAlGaAs) amplifying layer 3 over the first conduction (n) type buffer layer 2; a second conduction (p) type field controlling layer 4-8 over the amplifying layer 3; a second conduction (p) type light-absorbing layer 5 over the field controlling layer 4-8, the second conduction (p) type field controlling layer 4-8 comprising a central portion 4 and a peripheral portion 8 (note that at least part of the outer portion of layer 4 is etched away to make the remainder central to at least part of peripheral portion 8, since paragraph 0049 states that first mesa 18, which includes layer 4, is formed by etching to a depth crossing the boundary between layer 4 and amplifying layer 3) positioned on a side of the central portion 4 in a horizontal direction thereof, the central portion 4 having a charge density higher than that of the peripheral portion 8; a second conduction (p) type InAlAs buffer layer 6 over the light-absorbing layer 5; a first electrode 9 formed to electrically contact the first conduction (n) type buffer layer 2, and a second electrode 10 formed to electrically contact the second conduction (p) type InAlAs buffer layer 6; a second conduction (p) type InGaAs ohmic contact layer 7 formed between the second conduction (p) type InAlAs buffer layer 6 and the second electrode 10; and a passivation layer 11 covering a surface of the second conduction (p) type InGaAs ohmic contact layer 7 and a surface of the first conduction (n) type buffer layer 2. Note figure 1 and paragraphs 0011-0019 and 0046-0050 of Tanaka et al.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

A. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over TANAKA et al. (2002/0117697).

The first embodiment of Tanaka et al. discloses a photodiode with all the limitations of claim 5 except that each of the first conduction type buffer layer, the second conduction type field controlling layer, and the second conduction type buffer layer comprises an InP semiconductor layer, and that the second conduction type light-absorbing layer comprises an InGaAs semiconductor layer. Note figure 1 and paragraphs 0011-0019 and 0046-0050 of Tanaka et al.

However, the fifth embodiment of Tanaka et al. discloses a photodiode with an InP first conduction type buffer layer 252; an InP second conduction type field controlling layer 254-256 formed on an amplifying layer 253; an InGaAs second conduction type light-absorbing layer 257 formed on the field controlling layer 254-256; and an InP second conduction type buffer layer 258. Note figure 16 and paragraphs 101-102 of Tanaka et al. Therefore, it would have been obvious to a person having skill in the art to adjust the II-V alloy compositions of the first embodiment of Tanaka et al.'s photodiode so that each of the first conduction type buffer layer, the second conduction type field controlling layer, and the second conduction type buffer layer comprises an InP semiconductor layer, and so that the second conduction type light-absorbing layer comprises an InGaAs semiconductor layer such as taught by the second embodiment of

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Tanaka et al. in order to adjust the forbidden bandgaps of the respective layers to thus adjust for high yield depending on the wavelength of the light the diode is intended to detect.

B. Claims 6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over the first embodiment of TANAKA ET AL. (2002/0117697) in view of CLARK (4,326,211).

Tanaka et al. discloses a different photodiode with all the limitations of claims 6 and 9 except a first conduction type buffer layer comprising both an InP semiconductor layer and an InAlAs semiconductor layer and a second electrode formed in a ring structure so as to project a plurality of optical signals toward the second electrode. Note figure 1 and paragraphs 0011-0019 and 0046-0050 of Tanaka et al.

Clark discloses a photodiode having a first conduction type (n-type) buffer layer comprising n type InP semiconductor layer 101 and n+ InAlAs semiconductor layer 102 that is located adjacent to the multiplication region of the photodiode to provide a depletion stop at the n-side of the active portion of the photodiode. Clark also discloses a metal ring electrode 111 for exposing a light-absorbing region to incoming light, which allows the electrode to project a plurality of optical signals. Note figures 2 and 3; column 4 lines 15,16, and 26-33; and column 6 line 1 of Clark. Therefore, it would have been obvious to a person having skill in the art to augment of Tanaka et al.'s photodiode with the first conduction type buffer layer comprising an InP semiconductor layer and an InAlAs semiconductor layer and the second (p-side) electrode formed in a ring structure so as to project a plurality of optical signals toward the second electrode, such as taught

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by Clark in order, in the case of the first conduction type buffer layer, to provide a depletion stop at the n-side of the active portion of the photodiode, and, in the case of the ring-structured electrode, to expose the light absorbing region to incoming light, to thus provide a way to prevent electric field punch-through and resultant non-optically generated current, and to allow the light absorbing region access to light.

Response to Arguments

5. Applicant's arguments with respect to claims 1-6 and 8-10 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

6. Claims 7 and 25-30 are allowed over the references of record because none of these references disclosed or can be combined to yield the claimed invention such as a photodiode having all the elements of claim 1 (such a photodiode is anticipated by the first embodiment of Tanaka), and in addition either limitations that the field controlling layer includes an ion injection layer having a charge density of $3 \times 10^{12}/\text{cm}^2 \pm 20\%$, and that a charge density of a region of the second conduction type field controlling layer where the second conduction type ion injection layer is not formed is $2 \times 10^{12}/\text{cm}^2 \pm 20\%$, as recited in claim 7, or a limitation that the central portion of the field controlling layer comprises Be or Mg while the edge portion of the field controlling layer comprises neither Be nor Mg, as recited in claim 25.

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Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas L Dickey whose telephone number is 571-272-1913. The examiner can normally be reached on Monday-Thursday 8-6.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Thomas L. Dickey', is positioned above the printed name.

Thomas L. Dickey
Patent Examiner
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12/05